

Understanding Climate Policy Data Needs

NASA Carbon Monitoring System Briefing: Characterizing Flux Uncertainty Washington D.C., 11 January 2012

Molly E. Brown, Molly Macauley

For submission to EOS Transactions Meetings Summaries

Climate policy in the United States is currently guided by public-private partnerships and actions at the local and state levels. This mitigation strategy is made up of programs that focus on energy efficiency, renewable energy, agricultural practices and implementation of technologies to reduce greenhouse gases. How will policy makers know if these strategies are working, particularly at the scales at which they are being implemented? The NASA Carbon Monitoring System (CMS) will provide information on carbon dioxide fluxes derived from observations of earth's land, ocean and atmosphere used in state of the art models describing their interactions. This new modeling system could be used to assess the impact of specific policy interventions on CO₂ reductions, enabling an iterative, results-oriented policy process.

In January of 2012, the CMS team held a meeting with carbon policy and decision makers in Washington DC to describe the developing modeling system to policy makers. The NASA CMS will develop pilot studies to provide information across a range of spatial scales, consider carbon storage in biomass, and improve measures of the atmospheric distribution of carbon dioxide.

The pilot involves multiple institutions (four NASA centers as well as several universities) and over 20 scientists in its work. This pilot study will generate CO₂ flux maps for two years using observational constraints in NASA's state- of- the- art models. Bottom- up surface flux estimates will be computed using data- constrained land and ocean models; comparison of the different techniques will provide some knowledge of uncertainty

in these estimates. Ensembles of atmospheric carbon distributions will be computed using an atmospheric general circulation model (GEOS- 5), with perturbations to the surface fluxes and to transport. Top- down flux estimates will be computed from observed atmospheric CO₂ distributions (ACOS/GOSAT retrievals) alongside the forward- model fields, in conjunction with an inverse approach based on the CO₂ model of GEOS- Chem. The forward model ensembles will be used to build understanding of relationships among surface flux perturbations, transport uncertainty and atmospheric carbon concentration. This will help construct uncertainty estimates and information on the true spatial resolution of the top- down flux calculations. The relationship between the top- down and bottom- up flux distributions will be documented.

Because the goal of NASA CMS is to be policy relevant, the scientists involved in the flux modeling pilot need to understand and be focused on the needs of the climate policy and decision making community. If policy makers are to use CMS products, they must be aware of the modeling effort and begin to design policies that can be evaluated with information. Improving estimates of carbon sequestered in forests, for example, will require information on the spatial variability of forest biomass that is far more explicit than is presently possible using only ground observations. Carbon mitigation policies being implemented by cities around the United States could be designed with the CMS data in mind, enabling sequential evaluation and subsequent improvements in incentives, structures and programs.

The success of climate mitigation programs being implemented in the United States today will hang on the depth of the relationship between scientists and their policy and decision making counterparts. Ensuring that there is two-way communication between data providers and users is important for the success both of the policies and the scientific products meant to support them.